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GB A 2059202
GB A 2025720
GB 1592575
GB 1516027
GB 1507186
GB 1257520
GB 1193324
GB 1056265
GB 1019296
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(54) **Gain control of audio-amplifying systems**

(57) The gain of a conventional power amplifier AP is reduced, by means of a feedback circuit RT, as soon as the amplified signal overcomes a prefixed threshold value, determined by a peak detector C, near the saturation level of the same amplifier AP. An audio amplifier projected for a given maximum power can thus be used as if it was able to supply a higher power. When, at a signal peak, the threshold value (preferably fixed from 3 to 6dB below the saturation level of the amplifier) is exceeded the output of the comparator C acts on attenuator AT with a time constant determined by T so as to reduce the gain of the amplifier AP. The time constant circuit T enables the output signal of the comparator to charge a capacitor (C1, Figure 2) very quickly (nano μ sec) and as the output of the comparator C falls to zero the capacitor (C1) discharges slowly (e.g. 200 m sec) through resistor (R1). The variable attenuator AT may be of CMOS type.

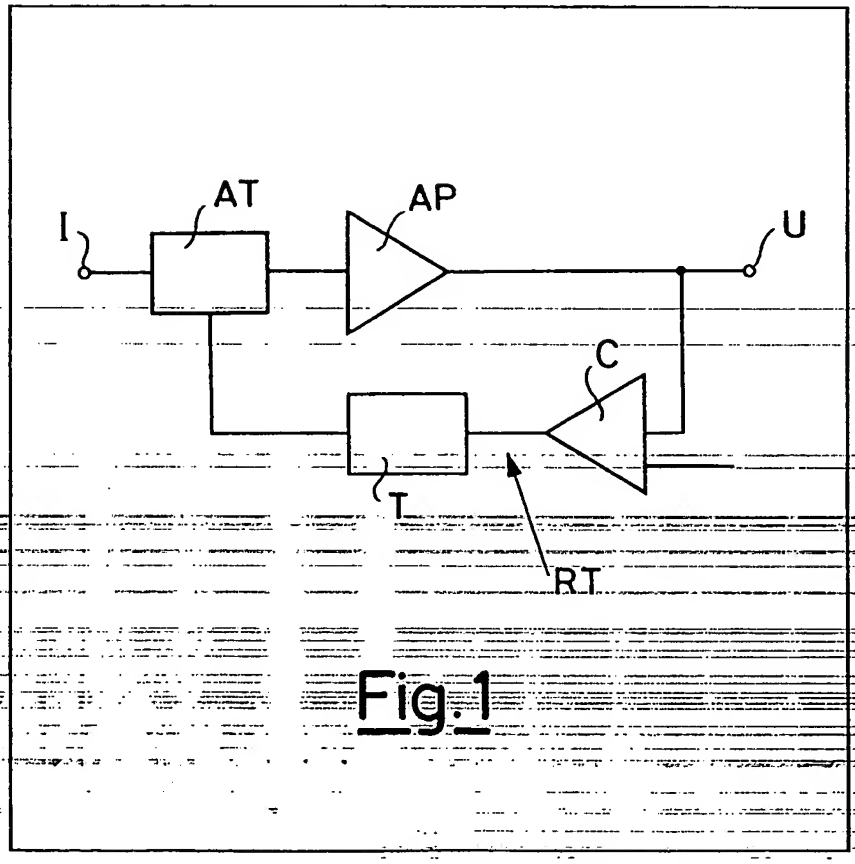

Fig.1

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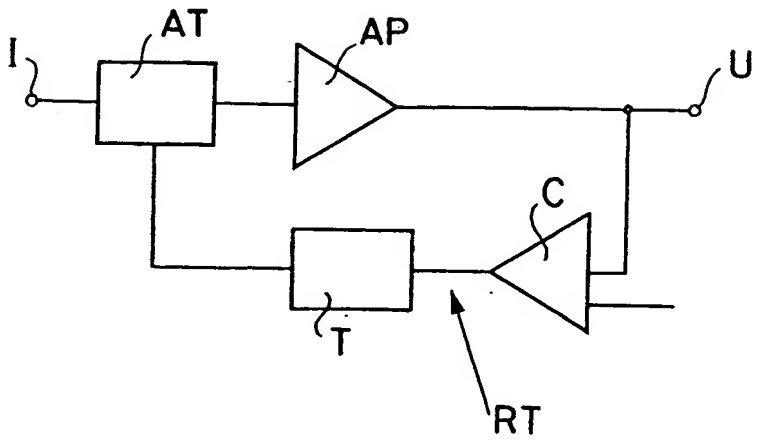

Fig.1

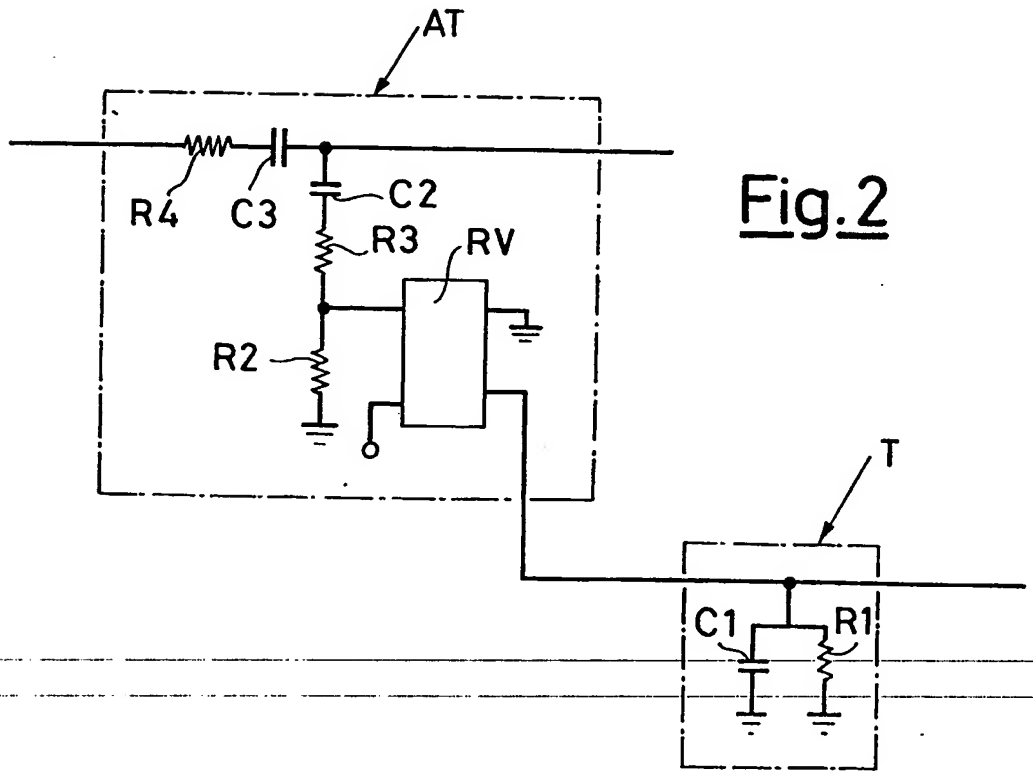

Fig.2

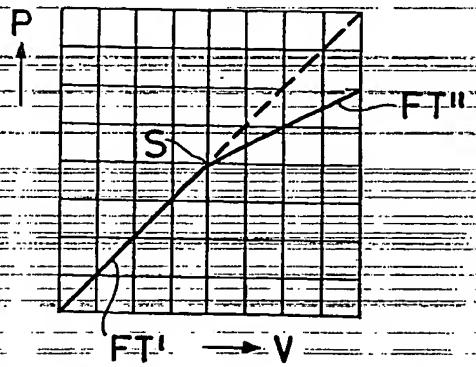

Fig.3

SPECIFICATION

Improvements in or relating to audio-amplifying systems

The present invention relates to an audio-amplifying system, which allows the average listening power of, for instance, a normal linear amplifier to be increased, while avoiding at the same time distortion during the signal peaks.

In order to avoid distortion during the peaks of a musical signal (phenomenon called "clipping") audio amplifiers for car radios, portable radios, television sets, Hi-Fi systems (high fidelity) and so on must be sized for maximum powers which are very high with respect to the average power of the signal to be handled.

For example, considering that the dynamics of registered musical signals provide with good approximation for a 16:1 (12dB) ratio between the peak power and the average listening power, a car radio amplifier with maximum output of 20 W with distortion of 10% can normally work at an average value of only 1.25 W.

Units able to reduce the above mentioned ratio, called "compressor/limiter" or "compressor/threshold limiter" (because of the adjustable intervention threshold) are already used in recording and broadcasting studies. However, they are complex and expensive units and need skilled techniques for their adjustment.

According to the invention, there is provided an audio amplifying system, comprising a power amplifier having a feedback loop including a prefixed-threshold peak detector and an adjustable attenuator controlled by the detector so as to reduce the gain of the amplifier when the detector detects a power peak higher than the prefixed threshold.

It is thus possible to provide an audio amplifying system which, without particular circuit complications and in a simple and automatic way, allows higher average powers to be handled without introducing undesired distortion to power peaks.

By opportunely and automatically reducing the amplifier gain at the power peaks, the possibility of using the same amplifier for higher average listening powers without any distortion at the power peaks is obtained.

Particularly it is possible to achieve 2 to 4 times higher average listening powers while using the same amplifier. Thus, it is possible to use an amplifier of a given maximum power as if it was able to supply a power 2 to 4 times higher.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of an audio amplifying system constituting a preferred embodiment of the invention;

Figure 2 is a detailed circuit diagram of part of the system of Figure 1; and

Figure 3 is a graph illustrating the transfer function of the amplifying system of Figure 1.

With reference to Figure 1, a conventional power amplifier AP, for example with a maximum output of 20 W, is interposed between a signal input I and an amplifier signal output U together with a feedback loop RT including a comparator or peak detector C having prefixed threshold, a regulator T for intervention time, and a variable attenuator AT, which is interposed between the signal input I and the amplifier AP.

Operation of the audio amplifying system of Figure 1 will be described with reference to the graph P/V (output power/input voltage) of Figure 3.

While the input voltage V generates an output power P lower than the value of the threshold S of the comparator C, the transfer function FT' of the amplifying system is of linear kind and completely equal to that of the amplifier AP.

When, at a signal peak, the threshold value (preferably fixed from 3 to 6 dB below the saturation level of the amplifier) is exceeded, the output of the comparator C acts on the attenuator AT, with an intervention time fixed to the regulator T, so as to reduce the gain of the amplifier AP (for example from 50 to 46 dB). The transfer function (FT') then remains linear but with reduced slope, as illustrated in Figure 3.

As a consequence, the amplifier AP is able to handle average powers higher than those normally allowed, without troublesome distortion at the power peaks. The amplifier can thus operate with average listening levels substantially from 2 to 4 times higher.

Since the system does not interfere at low power levels, there do not exist noise problems or pumping effects. The system can also be useful in reducing radio interference due to clipping. It is also possible for the system to be made in a nonlithic version with standard technology.

Figure 2 shows an embodiment of the circuit blocks T and AT of Figure 1. The intervention time regulator T comprises a capacitor C1 and a resistor R1 in parallel with each other. The variable attenuator AT comprises a variable resistance RV of C-MOS type, which is controlled by the output of the regulator T and is operatively connected in parallel with a resistor R2 and in series with another resistor R3 and with a capacitor C2 to form, downstream of a resistor R4 and a capacitor C3 connected in series, a variable resistive shunt able to change the gain of the amplifier AP.

When the threshold of the comparator C is exceeded, the output signal thereof charges very quickly (some μ sec) the capacitor C1, which then, as the output of the comparator C falls to zero, discharges very slowly (for example, 200 m sec) through the resistor R1. This succession of charging and discharging determines the intervention time of the feedback loop RT at every signal peak.

During the above mentioned time the value of the variable resistance RV is reduced and consequently so is the ratio between input and output of the attenuator AT and thus also the amplifier gain. The transfer function FT' is thus changed to the transfer function FT'', which allows higher average listening powers with the same amplifier.

CLAIMS

1. An audio amplifying system, comprising a power amplifier having a feedback loop including a prefixed-threshold peak detector and an adjustable attenuator controlled by the detector so as to reduce the gain of the amplifier when the detector detects a power peak higher than the prefixed threshold.

2. An audio amplifying system as claimed in claim 1, including an intervention time regulator inserted between the peak detector and the adjustable attenuator.

3. An audio amplifying system as claimed in claim 1 or 2, in which the threshold is fixed so as to be from 3 to 6 dB under the amplifier saturation level.

4. An audio amplifying system substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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